Viewing Distances

Task Statement 1

People like living at the top of tall buildings or hiking to the top of tall mountains because the views are amazing. From those heights, it is possible to see for great distances before Earth curves away from view at the horizon. For these questions, assume that Earth is perfectly spherical, with a radius of 6,371,000 meters, and that there are no obstacles to the view.

1. If you are standing on Earth's surface, what is the distance from your eye to the horizon?
2. If you were at a height of h meters above Earth's surface, what would be the distance from your eye to the horizon?
3. Different types of satellites orbit at different heights. Research different satellites and find out how high they orbit.
    a. Choose at least two types of satellites that orbit at different heights. How much of Earth's circumference could each satellite view at a time?
    b. What is the least number of satellites that would be needed to view the entire equator at the same time? How high did you assume they would orbit?
4. Choose another body in the solar system besides Earth.
    a. If you could stand on it, how far would you be able to see?
    b. Choose a feature on it, such as a crater or a mountain, or Jupiter's Great Red Spot. How high above its surface would you need to stand in order to see all of that feature?

Viewing Distances

Task Statement 2

People like living at the top of tall buildings or hiking to the top of tall mountains because the views are amazing. From those heights, it is possible to see for great distances before Earth curves away from view at the horizon. For these questions, assume that Earth is perfectly spherical, with a radius of 6,371,000 meters, and that there are no obstacles to the view.

1. If you are standing on Earth's surface, what is the distance from your eye to the horizon?
2. If you were on the top floor of one of the two Petronas Towers in Malaysia, at a height of 370 meters, what would be the distance from your eye to the horizon?
3. If you were at a height of h meters above Earth's surface, what would be the distance from your eye to the horizon?
4. The International Space Station (ISS) is 408,773 meters above Earth's surface. If you were an astronaut on the ISS, what fraction of Earth's circumference would you be able to see?
5. How many satellites orbiting at the height of the ISS would be needed in order to view all of the equator at the same time?
6. What is the least number of satellites that would be needed to view the entire equator at the same time? How high did you assume they would orbit?